

WHAT IS CLAIMED IS:

1. A flat plate heat transfer device, one end of which is contacted with a heat source and the other end of which is contacted with a heat emitting unit, the device 5 transferring heat generated at the heat source to the heat emitting unit in a horizontal direction, the device comprising:

a thermally-conductive flat case containing a working fluid that is evaporated with absorbing heat from the heat source and condensed with emitting heat to the heat emitting unit; and

10 a mesh aggregate installed in the case and configured so that coarse mesh and fine mesh in which wires are woven to be alternately crossed up and down are vertically laminated with being contacted with each other,

wherein the coarse mesh provides main-directional and sub-directional vapor dispersion channels with different sectional areas at each crossing point of mesh wires so 15 that vapor evaporated from the working fluid is capable of flowing therethrough, the main-directional vapor dispersion channel with a relatively larger sectional area being parallel to a heat transfer direction,

wherein the fine mesh provides liquid flow channels along a surface of the mesh wires.

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2. The flat plate heat transfer device according to claim 1,

wherein an opening width [$M=(1-Nd)/N$, where N is a mesh number, and d is a wire diameter (inch)] of the coarse mesh is 0.19 to 2.0 mm.

25 3. The flat plate heat transfer device according to claim 1, wherein the coarse

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mesh has a wire diameter of 0.17 to 0.5 mm.

4. The flat plate heat transfer device according to claim 1, wherein the coarse mesh has an opening area of 0.036 to 4.0 mm².

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5. The flat plate heat transfer device according to claim 1, wherein the coarse mesh has a mesh number from 10 to 60 on the basis of ASTM specification E-11-95.

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6. The flat plate heat transfer device according to claim 1, wherein an opening width [M=(1-Nd)/N, where N is a mesh number, and d is a wire diameter (inch)] of the fine mesh is 0.019 to 0.18 mm.

7. The flat plate heat transfer device according to claim 1, wherein the fine mesh has a wire diameter of 0.02 to 0.16 mm.

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8. The flat plate heat transfer device according to claim 1, wherein the fine mesh has an opening area of 0.00036 to 0.0324 mm².

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9. The flat plate heat transfer device according to claim 1, wherein the fine mesh has a mesh number from 80 to 400 on the basis of ASTM specification E-11-95.

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10. The flat plate heat transfer device according to claim 1, wherein the mesh aggregate is configured to include the fine mesh arranged adjacent to the heat source and the coarse mesh laminated thereon adjacent to the heat emitting unit, from bottom to top.

11. The flat plate heat transfer device according to claim 1,
wherein the mesh aggregate is configured so that the coarse mesh is interposed
between two layers of fine meshes.

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12. The flat plate heat transfer device according to claim 11,
wherein at least one layer of additional fine mesh is provided in at least a part of
the coarse mesh interposed between the fine meshes so as to give a liquid channel by
interconnecting the fine meshes.

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13. The flat plate heat transfer device according to claim 1,
wherein the mesh aggregate further includes at least one layer of intermediate
mesh whose mesh number is relatively larger than that of the coarse mesh and relatively
smaller than that of the fine mesh.

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14. The flat plate heat transfer device according to claim 13,
wherein the coarse mesh is laminated between the fine mesh and the intermediate
mesh.

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15. The flat plate heat transfer device according to claim 14,
wherein at least one layer of additional fine mesh is provided in at least a part of
the coarse mesh interposed between the fine mesh and the intermediate mesh so as to
give a channel by interconnecting the fine mesh and the intermediate mesh.

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16. The flat plate heat transfer device according to claim 14,

wherein at least one layer of additional intermediate mesh is provided in at least a part of the coarse mesh interposed between the fine mesh and the intermediate mesh so as to give a channel by interconnecting the fine mesh and the intermediate mesh.

5 17. The flat plate heat transfer device according to claim 14,
wherein the fine mesh is arranged adjacent to the heat source, and the intermediate mesh is arranged adjacent to the heat emitting unit.

10 18. The flat plate heat transfer device according to claim 14,
wherein the fine mesh is arranged adjacent to the heat source so that the working fluid is evaporated into a vapor by means of heat absorbed from the heat source,
wherein the coarse mesh is arranged in contact with the fine mesh so as to give a channel for the vapor to flow,
wherein the intermediate mesh is arranged in contact with the coarse mesh and
15 adjacent to the heat emitting unit so that the vapor is condensed with emitting heat to the heat emitting unit.

19. The flat plate heat transfer device according to claim 18,
wherein the intermediate mesh has a vapor flow space so that the vapor
20 introduced from the coarse mesh flows therein.

20. The flat plate heat transfer device according to claim 1, further comprising:
a wick structure installed in contact with the mesh aggregate and located under
25 the mesh aggregate within the case, the wick structure having unevenness on a surface so

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that the working fluid is contained and flowed therein and at the same time evaporated by means of heat absorbed from the heat source and flowed toward the mesh aggregate.

21. The flat plate heat transfer device according to claim 20,
5 wherein the wick structure is formed by sintered copper, stainless steel, or nickel powder.

22. The flat plate heat transfer device according to claim 20,
wherein the wick structure is formed by etching polymer, silicon, silica, copper,
10 stainless steel, nickel, or aluminum plate.

23. The flat plate heat transfer device according to claim 1,
wherein the case is made of electrolytic copper foil so that an inner surface
having prominence and depression is used as the wick structure.

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24. The flat plate heat transfer device according to any of claims 1 to 23,
wherein the mesh is made of metal, polymer, or plastic.

25. The flat plate heat transfer device according to claim 24, wherein the
20 metal is copper, aluminum, stainless steel, molybdenum, or their alloy.

26. The flat plate heat transfer device according to any of claims 1 to 23,
wherein the case is made of metal, polymer, or plastic.

25 27. The flat plate heat transfer device according to claim 26, wherein the

metal is copper, aluminum, stainless steel, molybdenum, or their alloy.

28. The flat plate heat transfer device according to any of claims 1 to 23, wherein the working fluid is water, ethanol, ammonia, methanol, nitrogen, or Freon.

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29. The flat plate heat transfer device according to claim 28, wherein an amount of filled working fluid is 80 to 150% of wick porosity.

10 30. The flat plate heat transfer device according to any of claims 1 to 23, wherein the fine mesh has main-directional and sub-directional liquid flow

channels with different sectional areas,

wherein the main-directional liquid flow channel is parallel to a heat transfer direction.

15 31. The flat plate heat transfer device according to any of claims 13 to 19,

wherein the intermediate mesh has main-directional and sub-directional liquid

flow channels with different sectional areas,

wherein the main-directional liquid flow channel is parallel to a heat transfer direction.

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32. A method for manufacturing a flat plate heat transfer device, which includes a thermal-conductive flat case and a mesh aggregate mounted in the flat case, and which transfers heat in a horizontal direction with the use of a circulating mechanism of a working fluid by means of the mesh aggregate, the method comprising:

25 (a) forming upper and lower plates of the flat case, respectively;

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(b) preparing a mesh aggregate with a structure that coarse mesh, in which wires are woven to be alternately crossed up and down, for giving vapor dispersion channels and fine mesh, in which wires are woven to be alternately crossed up and down, for giving liquid flow channels are laminated to be vertically opposite to each other, the 5 coarse mesh having main-directional and sub-directional vapor dispersion channels with different sectional areas at each crossing point of mesh wires so that vapor evaporated from the working fluid is capable of flowing therethrough;

(c) inserting the mesh aggregate between the upper and lower plates, and adjusting a direction of the mesh aggregate so that the main-directional vapor dispersion 10 channels of the coarse mesh are parallel to a heat transfer direction;

(d) forming a flat case by uniting the upper and lower plates with leaving a working fluid injection hole;

(e) decompressing an inside of the united case into a vacuum through the working fluid injection hole and then injecting a working fluid therethrough; and

15 (f) sealing the flat case with the working fluid injected therein.

33. The method for manufacturing a flat plate heat transfer device according
to claim 32,
wherein, in the step (b), the fine mesh is selected to have main-directional and
20 sub-directional liquid flow channels with different sectional areas at each crossing point
of mesh wires so that vapor evaporated from the working fluid is capable of flowing
therethrough, and the mesh aggregate is prepared so that the main-directional liquid flow
channels of the fine mesh are parallel to the main-directional vapor dispersion channels
of the coarse mesh.